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Abstract

A large body of literature has examined the effect of parental employment--primarily maternal employment--on the amount of time spent with children and in childcare activities, and it is well documented that employed parents spend less time with their children than nonemployed parents. But not all time is equal. Research on circadian rhythms suggests that children's ability to benefit from parents' enriching childcare activities, such as reading to and playing with their children, varies by time of day. Thus, we would expect parents to engage in these enriching activities at times of day when it is the most valuable to their children. If employment causes parents to shift their childcare activities away from times when it is the most valuable, then differences in the amount of time that employed and nonemployed parents spend in childcare underestimate the effect of employment on parents' quality-adjusted time with their children.

In this study, we examine whether employment results in parents shifting the time spent engaging in childcare activities to times that may be less productive. We develop a simple model of timing that predicts that parents will spend more time with their children when it is most productive. We then use data from the American Time Use Survey to compare workdays to nonwork days, and find that employment significantly affects the timing of enriching childcare activities for both mothers and fathers who are employed full time. In particular, these parents shift enriching childcare activities into the evening hours. In contrast, part-time employment has a much smaller effect on when mothers spent time with their children. Thus, part-time employment not only allows mothers to spend more time with their children compared to full-time employment, it also allows them to spend that time when it may be the most beneficial and enjoyable.

Introduction

Parental time spent in enriching childcare activities, such as playing with and reading to children, is arguably one of the most important parental inputs into child development. A large body of literature has examined the effect of employment on the amount of time that parents spend providing childcare,¹ but there has been almost no research on *when* that care is provided.² The timing of childcare matters because not all time is equally valuable; for example, time spent in enriching childcare activities is likely to be more beneficial to the children and more enjoyable to parents at times when children are more receptive to learning and parents are not tired. If it is the amount of quality-adjusted time with children that matters and employment causes parents to shift enriching childcare to “less-productive” times of day, then looking only at the amount of time in enriching childcare understates the full impact of employment on parental time with children.

The large literature on circadian rhythms examines how biological functions vary over the course of the day.³ One facet of this research focuses on individuals’ preferences for certain times of day, with individuals being classified as preferring either mornings or evenings. These studies are based on the Morningness-Eveningness Questionnaire (MEQ), which is designed to assess the subjects’ preferences.⁴ Most of the research has focused on teenagers and young adults, and older individuals. Teens and young adults generally prefer afternoons and evenings, while older individuals tend to prefer mornings. Other studies have shown that performance on

¹ For example, see Bianchi (2000, 2006) and Bianchi, Robinson, and Milkie (2006).

² Craig (2006) presents some evidence that employed mothers are less likely to spend time with their children in the morning and the afternoon.

³ This discussion is based on Hasher, Goldstein, and May (2005), which contains a nice summary of the relevant research on this topic.

⁴ The MEQ asks respondents about preferred times for doing certain types of activities, as well as preferred times for waking up and going to sleep.

complex tasks was better at preferred times of day, whereas performance on routine problem-solving tasks is invariant to the time of day.

There is less research available on the time-of-day preferences of young children. Two studies have examined the morningness/eveningness of 8-16 year olds (Kim, et al 2002) and 2-6 year olds (Wickersham 2006). In the latter study, the MEQ was adapted so that parents could answer for their children. The Kim, et al study found that younger children preferred the mornings, while older children preferred afternoons and evenings. The crossover point for this change is at about age 13. The Wickersham study found that preschool-age children preferred mornings, and that the preference was quite strong in two- and three-year-olds. If young children also perform better on complex tasks at their preferred time of day, then we might expect enriching care to be more valuable and thus more “productive” in the morning than in the afternoon and evening.

If time of day affects the benefits that parents receive from parent-child interactions, then we would expect parents to have preferences about when they spend time with their children.⁵ Our main concern is enriching activities because they are an important input to child development, the value of time spent in these activities is likely to depend on time of day, and they can be easily shifted to other times. We seek to determine whether employed parents shift their childcare activities from more-productive times to less-productive times, thus reducing the value of parental time with children.

We begin by developing a simple model of timing. The model predicts that, all else equal, parents will spend more time with their children at times when the time is most productive. It is important to note that productivity depends on the parents’ time-of-day

⁵ Parents’ preferences will depend on the weight attached to their eveningness preference and the morningness preference of their children. Given that the enriching care activities are likely to be complicated for young children and relatively routine for their parents, we would expect mornings to be the best time for these interactions.

preferences as well as those of the children. The productivity of time spent in other activities can vary by time of day as well. If time spent in work activities is more productive during normal working hours, then we would expect parents to shift time with children away from workdays and away from normal working hours on workdays. If time with children is also more productive during normal work hours compared to evening hours, then we would expect to see parents spend more time with their children during these hours on their nonwork days. On the other hand if time with children is most productive at times other than normal working hours, then employment should not affect when parents spend time with their children and the pattern of when parents spend time with their children should be the same time on workdays and nonwork days.

A Simple Model of Timing

In this section we present a simple economic model that shows how variation in the productivity of time spent in different activities over the course of the day affects when people choose to engage in those activities.⁶ For convenience and ease of exposition we assume that individuals optimize in two stages. In the first stage, the individual maximizes utility and determines the optimal amount of time to spend in each activity during a given period of time, such as a day. In the second stage, the individual determines how that time spent in each activity is distributed over the sub-periods, such as morning or evening.⁷ For simplicity, we assume that there are two sub-periods and two activities.

⁶ There is relatively little research on the timing of activities. Our model is most similar to that in a study examining the effect of weather on the timing of work and leisure activities (Conolly 2008). Two other studies examine the timing of work activities (Hamermesh, Knowles, and Pocock 2006) and the coordination of husbands' and wives' time with children (Paley 2006). An early paper by Winston (1982) presents a theoretical model of timing.

⁷ Technically, it would be more realistic to solve the utility maximization problem in one stage with the time spent in each activity at each time as an argument in the utility function. But it is easier to see the intuition in the two-stage model.

First Stage Optimization: Individuals receive utility from time spent in enriching childcare, A , and all other activities, X , which include leisure, household work, and working for pay.⁸ The productivity of time spent in each of these activities is given by the functions $\Gamma(\gamma)$ for activity A and $\Theta(\theta)$ for X , where the arguments γ and θ are vectors of productivities for the sub-periods and $\Gamma_i, \Theta_i > 0$ for $i = 1, 2$. Each parent solves the following first-stage optimization program:

$$\text{Max}_{A,X} U(\Gamma(\gamma)A, \Theta(\theta)X) \quad \text{s.t. } A + X = 2T,$$

where T is the amount of time in each sub-period. The solution to this program is straightforward and the optimal values of A and X will be denoted as A^* and X^* .

Second Stage Optimization: Parents distribute the time spent in the two activities to the two time periods based on the productivity of the activities in the sub-periods. Again, keep in mind that the productivity of time spent in childcare depends on the parent's and children's time-of-day preferences, as well as any interaction effects. Letting a_i and x_i denote the time spent in childcare and in other activities, the maximization program can be written as:

$$\begin{aligned} \text{Max} \quad u &= \gamma_1 f(a_1) + \gamma_2 f(a_2) + \theta_1 g(x_1) + \theta_2 g(x_2) \\ \text{s.t.} \quad a_1 + a_2 &= A^* \\ x_1 + x_2 &= X^* \\ a_1 + x_1 &= T \\ a_2 + x_2 &= T \end{aligned}$$

Substituting in the last two constraints, the Lagrangian is:

⁸ The utility from X therefore includes utility derived from goods purchased from labor market earnings as well as the utility of leisure and the utility derived from household production. A more traditional model that includes market work and leisure as separate activities, includes consumption of market goods, and explicitly models household production would be more complicated but the important results would not change.

$$\mathcal{L} = \gamma_1 f(a_1) + \gamma_2 f(a_2) + \theta_1 g(T - a_1) + \theta_2 g(T - a_2) + \lambda_A (A^* - a_1 - a_2) + \lambda_X (X^* - [2T - a_1 - a_2]),$$

and the first order conditions with respect to a_1 and a_2 are:

$$(1) \quad \begin{aligned} \mathcal{L}_{a_1} &= \gamma_1 f'(a_1) - \theta_1 g'(T - a_1) + \lambda_X - \lambda_A = 0 \\ \mathcal{L}_{a_2} &= \gamma_2 f'(a_2) - \theta_2 g'(T - a_2) + \lambda_X - \lambda_A = 0, \end{aligned}$$

which can be rewritten as:

$$(2) \quad \begin{aligned} \gamma_1 f'(a_1) &= \theta_1 g'(T - a_1) + \lambda_A - \lambda_X \\ \gamma_2 f'(a_2) &= \theta_2 g'(T - a_2) + \lambda_A - \lambda_X \end{aligned}$$

Combining the equations in (2) yields the following equilibrium condition:

$$(2') \quad \gamma_1 f'(a_1) - \theta_1 g'(T - a_1) = \gamma_2 f'(a_2) - \theta_2 g'(T - a_2)$$

which states that the individual equates the difference between the marginal utilities of the two activities across the two time periods.⁹ We know from (1) that this difference is $(\lambda_A - \lambda_X)$.

Figure 1 graphs the equations in (2) and illustrates the equilibrium.

For our question, we are interested in how differences in productivity affect the amount of time spent in activity A in the two sub-periods. An increase in γ_1 affects a_1 and a_2 directly though changes in the relative productivities of A and X in sub-periods 1 and 2, and indirectly through a change in A^* . The former effect is akin to a substitution effect, while the latter is akin to a scale effect.

⁹ The inequality of the marginal products is an artifact of the two-stage optimization program and the adding-up constraint in the second stage.

The substitution effect can be seen by holding A^* (and hence X^*) constant and totally differentiating the equilibrium condition for the second stage in equation (2') with respect to γ_1 using the implicit function rule, yielding the following:

$$(3) \quad \left. \frac{da_1^*}{d\gamma_1} \right|_{dA^*=0} = \frac{-f'(a_1^*)}{\gamma_1 f''(a_1^*) + \theta_1 g''(x_1^*) + \gamma_2 f''(a_2^*) + \theta_2 g''(x_2^*)} > 0.$$

Thus an increase in the productivity of activity A in sub-period 1 increases the time spent on activity A in sub-period 1 holding the total amount of time spent on activity A constant.¹⁰ In Figure 2, this is illustrated as an upward shift in the $\gamma_1 f'(a_1)$ curve. The $\theta_1 g'(T - a_1) + \lambda_A - \lambda_X$ and $\theta_2 g'(T - a_2) + \lambda_A - \lambda_X$ curves also shift upward, because the first constraint becomes more binding (it is easily shown that $\partial \lambda_A / \partial \gamma_1 > 0$), such that $\Delta a_1 = -\Delta a_2$. Similarly,

$$(4) \quad \left. \frac{da_1^*}{d\theta_1} \right|_{dA^*=0} = \frac{-g'(x_1^*)}{\gamma_1 f''(a_1^*) + \theta_1 g''(x_1^*) + \gamma_2 f''(a_2^*) + \theta_2 g''(x_2^*)} < 0,$$

so that an increase in the productivity of other activities decreases the time spent in A in sub-period 1.

The direction of the scale effect is ambiguous. Totally differentiating the first-stage equilibrium condition yields:

$$\frac{dA^*}{d\gamma_1} = - \frac{[U_{11}\Gamma_1(\gamma)A^*\Gamma(\gamma) + U_1\Gamma_1(\gamma) - U_{21}\Gamma_1(\gamma)A^*\Theta(\theta)]}{U_{11}\Gamma(\gamma)^2 - U_{21}\Gamma(\gamma)\Theta(\theta)},$$

which reduces to:

¹⁰ If the daily production function is specified as $f(\gamma_1 a_1)$ instead of $\gamma_1 f(a_1)$, then $da_1^*/d\gamma_1$ is positive as long as the elasticity of marginal product with respect to quality-adjusted time is greater than -1 . If the marginal product function is elastic, then the amount of quality-adjusted time increases, but actual time decreases. The result in equation (4) also depends on the assumption that utility in the second stage is additively separable across activities and time periods. However, this assumption seems reasonable over short period of time such as a day or so.

$$\frac{dA^*}{d\gamma_1} = \frac{-\Gamma_1(\gamma)A^* \cdot \left(\delta_{U_1, \Gamma A} - \frac{A^*}{X^*} \delta_{U_1, \Theta X} + 1 \right)}{\Gamma(\gamma) \cdot \left(\delta_{U_1, \Gamma A} - \frac{A^*}{X^*} \delta_{U_1, \Theta X} \right)} \gtrless 0,$$

where $\delta_{U_1, \Gamma A} < 0$ is the own elasticity of the marginal utility with respect to quality-adjusted time in A (which equals $\Gamma \cdot A$) and $\delta_{U_1, \Theta X}$ is the elasticity with respect to quality-adjusted time in X

(which equals $\Theta \cdot X$). If $-1 < \left(\delta_{U_1, \Gamma A} - \frac{A^*}{X^*} \delta_{U_1, \Theta X} \right) < 0$ then $\frac{dA^*}{d\gamma_1} > 0$. If A^* is small relative to

X^* , as would be the case for enriching childcare activities, then $\frac{dA^*}{d\gamma_1} > 0$ if $-1 < \delta_{U_1, \Gamma A} < 0$.

The effect of employment on the timing of childcare can be seen by comparing work days and nonwork days. Workdays differ from nonwork days in that the productivity of “other activities,” which includes paid work, is higher. Because our main focus is on the timing of enriching childcare over the course of the day, we do not explicitly model the shifting of activities between days. However, it is relatively straightforward to extend our model to multiple days, and we will discuss between-day shifting on childcare in the context of the model. For simplicity, suppose that the productivity of childcare is higher in period 1 than in period 2 and that the productivity does not depend on whether the day in question is a workday

$(\gamma_1^N = \gamma_1^W > \gamma_2^N = \gamma_2^W)$, where the W and N superscripts denote workdays and nonwork days.

Other activities are assumed to have the same productivity in both periods on nonwork days and have higher productivity in period 1 on workdays ($\theta_1^W > \theta_1^N = \theta_2^N = \theta_2^W$). The higher productivity of other activities in period 1 reflects the higher productivity of work during normal work hours due to the coordination of work activities (see Hamermesh, Knowles, and Pocock 2006). Thus, we would expect individuals to work more in period 1 on workdays. This has two

implications for childcare. First, employed individuals will shift childcare activities from workdays to nonwork days. Second, and more importantly, childcare done on workdays will be shifted from period 1 to period 2.

Data

We use pooled 2003-2006 data from the American Time Use Survey (ATUS).¹¹ The ATUS is a time-diary survey that asks respondents to sequentially describe their activities, which are translated into over 400 detailed activity codes, during a 24-hour period that we refer to as the diary day.¹² Twenty-six different activity codes describe childcare of household children, and for this analysis we defined three broad categories of childcare: routine care (such as feeding or bathing), enriching care (such as reading to or playing with children), and other childcare (such as travel). (See Appendix A for detailed definitions.) For each episode, the ATUS collects the start and stop times, who else was present, and where the respondent was. The ATUS also contains demographic information for all household members and labor force information (including labor force status and usual hours worked) for the respondent and the respondent's spouse or unmarried partner.

The ATUS interviews one person per household and each respondent is interviewed only once about the day prior to the interview. Thus it is not possible to directly observe the shifting of activities between work and nonwork days. Instead, we compare employed parents who were interviewed about a workday to those who were interviewed about a nonwork day, keeping in

¹¹ A more complete description of the ATUS can be found in Hamermesh, Frazis, and Stewart (2005) and Frazis and Stewart (2007).

¹² If respondents report doing more than one thing at one time (such as cooking while talking to a child), only the activity reported as the primary (or "main") activity is coded. However, traveling--even when done in conjunction with another activity, such as feeding a child--is always considered the primary activity. The diary day starts at 4am "yesterday" and ends at 4am "today."

mind that whether a given diary day is a work day or a nonwork day is exogenously determined because respondents are pre-assigned to be interviewed about a particular day of the week.

To isolate the effect of work-related constraints on when parents provide childcare, it is important to eliminate the effects of school on parental time with children.¹³ Therefore, we restricted our sample to parents aged 18 and older who have at least one pre-school age child (under age 5) living in the household.¹⁴ This leaves us with a sample size of 9,103. Approximately 50 percent of these parents also have children that are age 5 or older and so provide childcare to these children as well. For this reason, only childcare activities that were done when a child under age 5 was present are counted as childcare.

Table 1 shows the average number of hours per day spent in childcare activities by employed and nonemployed parents. Employed mothers are divided into full-time and part-time workers. Fathers who work part time are excluded from the analysis due to the small sample size. Mothers spend considerably more time in childcare than fathers regardless of employment status. Nonemployed mothers spend more time in childcare (3.1 hours per day) than either part-time employed mothers (2.7 hours) or full-time employed mothers (2.1 hours). Nonemployed fathers spend more time in childcare activities than full-time employed fathers, but not as much as nonemployed mothers.

Routine care accounts for most of the time spent in childcare. Enriching care accounts for about 33% of mothers' childcare time and a little over 40% of fathers' childcare time; there is little variation in these fractions by employment and full/part time status. Working fewer hours increases the amount of time spent on both routine and enriching care by about the same relative amount.

¹³ Note that older children may also be present.

¹⁴ "Parents" are those with biological children, stepchildren, or adopted children.

Workdays vs. Nonwork Days

Table 1 also shows how childcare is divided between workdays and nonwork days. Because parents working at home can provide significant amounts of childcare, workdays are defined as those days respondents reported working somewhere other than at home. Employed parents spend less time in childcare on workdays than on nonwork days. Somewhat surprisingly, the difference between workdays and nonwork days is greater for part-time employed mothers than it is for full-time employed mothers (about 70 minutes less per day vs. about 45 minutes less for full-time employed mothers).

We can also see from Table 1 that employed parents spend more time in childcare activities on nonwork days than they do on workdays. Both mothers and fathers spend more time on routine care and enriching care on nonwork days compared to workdays. The two largest components of enriching care are playing with children and reading to children. Parents spend more time playing with children on nonwork days, but the amount of time parents spend reading to children—which is mostly done at night—is about the same on work and nonwork days. Other childcare, which includes transporting children, is also about the same on work and nonwork days.

These findings are consistent with our prediction that parents will shift childcare time from work days to nonwork days (except for “other childcare” and “reading to children” as discussed previously). They are also consistent with the findings of Stafford and Yeung (2005) that children spend more time with their parents on weekend days than on weekdays.

The Timing of Childcare

The timing of enriching childcare activities depends on the relative productivities of childcare and other activities at different times of the day. Given our assumption that the

productivity of time spent in non-enriching childcare activities does not depend on time of day on nonwork days, the timing of enriching care on those days depends only on the productivity of enriching care at different times of day.

Our empirical strategy is to compare the timing of childcare on workdays and nonwork days. Since we cannot observe the same person on both a workday and a nonwork day, there are two possible control groups for the nonwork days—nonemployed parents and employed parents on nonwork days. Using nonemployed persons as the control group is potentially problematic because the employment decision may be related to unobserved differences in productivity. For example, individuals whose childcare time is relatively productive in the evening may be more likely to be employed full time. If this is the case, we would expect these individuals to concentrate their childcare activities in the evening on their nonwork days as well. This leads us to use the nonwork days of the employed as the control group, which eliminates the endogeneity issue because the two comparison groups have exactly the same characteristics. The important thing to note is that parents were randomly assigned to days, so that whether a parent is observed on a workday or a nonwork day is exogenous. Thus the work-schedule effect is identified by comparing the timing of childcare of parents who were interviewed on a workday to those who were interviewed on a nonwork day.¹⁵

The research on circadian rhythms suggests that mornings may be the best time (from the child's perspective) for enriching care. However, because it is the parent's utility that is being maximized and productivity depends on parent's and children's time-of-day preferences, it is not

¹⁵ As it turns out, it does not make much difference whether we use the nonemployed or nonwork days of the employed as our reference group. This is consistent with our supposition that it is the morningness preference of children that drives productivity, rather than the eveningness of their parents. Also, research on the nonemployed (Frazis and Stewart 2005) has shown that the nonwork days of workers are very similar to the average day of the nonemployed. In other results (not presented here), we found the timing of enriching childcare activities of the nonemployed to be similar to that of the employed on nonwork days.

crucial that enriching childcare occur in the mornings—only that there is a difference between workdays and nonwork days.

Figure 2 shows the fraction of parents that are engaged in any type of childcare by time of day for full-time employed mothers, part-time employed mothers, full-time employed fathers, and nonemployed parents. The graphs for employed parents show the fraction engaged in childcare on work and nonwork days.

Panel (a) shows the graph for mothers who are employed full time. As we would expect, workdays and nonwork days are quite different. On workdays, childcare activities are concentrated in the mornings and evenings, with few mothers engaging in childcare in the middle of the day. On nonwork days, childcare is more evenly distributed throughout the day and the peaks are far less pronounced. The fraction providing care is higher on nonwork days between 8am until about 5:00pm. Before 8am, there is sharp spike in the percentage of mothers who are providing childcare on workdays. After 5:00pm, there is little difference between the percentage of mothers providing childcare on workdays and nonwork days

Compared with mothers who work full time, a higher fraction of part-time employed mothers provide childcare between 8:00am and 5:00pm on both workdays and nonwork days (panels a and b). Part-time employed mothers who worked on their diary days are more likely to be providing childcare in the middle of the day compared with full-time employed mothers who worked. On nonwork days full- and part-time employed mothers look more similar to each other, although a larger fraction of part-time employed mothers are engaging in childcare at most times of the day.

The graph for full-time employed fathers is similar to the graph for full-time employed mothers except that the fraction of fathers providing care at any given time is lower (Panel c).

Also, the morning spike is smaller for fathers, which may reflect the fact that they are less likely than full-time employed mothers to have a spouse who works full time. The fraction of fathers providing care on workdays is largest in the morning and the evening, with very few providing care in the middle of the day. On nonwork days, the fraction providing care hovers around 10 percent from 8am to 6pm. From about 6pm on, the fraction of fathers providing childcare is about the same on workdays and nonwork days.

Panel (d) shows nonemployed mothers and fathers. As with employed parents on nonwork days, childcare is fairly evenly distributed between 7am and 9pm, although a greater fraction of nonemployed mothers provide childcare than do fathers. The fraction of mothers providing childcare hovered between 15 and 25 percent between 7am and 9pm, whereas the fraction of fathers mostly ranged between 5 and 15 percent.

Figure 3 shows the same set of graphs for routine care. On workdays for both fathers and mothers, this care is concentrated in the morning before work and in the evening after work (panels a, b, and c). On nonwork days routine care is more evenly distributed throughout the day, although there are still noticeable peaks in the morning and the evening. The graph for the nonemployed mothers also shows morning and evening peaks, while the peaks are not noticeable for nonemployed fathers (panel d). The morning peak appears to last longer on nonwork days than it does on workdays, suggesting that these routine activities may be done later or at a more leisurely pace, which could be viewed as a form of shifting. The evening spike associated with putting children to bed is performed at about the same time of day by all groups (except nonemployed fathers) on both work and nonwork days.

The same set of graphs for enriching childcare activities is shown in Figure 4. The fraction of parents engaged in enriching activities is relatively small at every time of day, which

reflects the fact that most childcare is routine. Panel (a) shows the graph for mothers who are employed full time. Only a small fraction of mothers who worked--about 1 percent--are engaged in enriching activities from 8am through mid-afternoon. The fraction is much higher on nonwork days, between 3 and 7 percent, with the small spikes occurring in the mid-morning and late afternoon. The evening peak is about the same on workdays and nonwork days. Fathers who work full time look very similar to mothers who work full time on both workdays and nonwork days (panel c).

The graph for part-time employed mothers (panel b) indicates that they are more likely to be engaged in enriching activities earlier in the day on both workdays and nonwork days compared to full-time employed mothers and fathers. On nonwork days, the largest fraction is engaged in enriching activities in the mid-morning and mid-to-late afternoon, with the afternoon fraction being quite a bit higher. The pattern is similar on workdays, although the fraction is lower except during the evening. Nonemployed mothers and fathers are very similar to each other (panel d).

These figures make it clear that a small fraction of parents are engaging in enriching childcare at any given time, that there are large differences between workdays and nonwork days of employed parents, and that nonwork days of employed parents are similar to average days of nonemployed parents.

For our next analysis, it is more convenient to graph the difference between workdays and nonwork days in the fraction of parents engaged in enriching activities at each time of day. We estimated separate OLS regressions for each time of day between 6:00am and 11:00pm at 5-minute intervals (204 equations total).¹⁶ The dependent variable equals one if the parent was

¹⁶ We also estimated logit equations. Logits have the obvious advantage that the results can be expressed as odds ratios. However, it is more difficult to see the pattern by time of day because the value of the odds ratio depends on

engaged in enriching activities at that time and the independent variable of interest is a dummy variable that equals one if the individual worked (away from home) during the day. To eliminate the effect of shifting enriching childcare activities from workdays to nonwork days and focus on timing, we dropped parents who did no enriching care on their diary day.¹⁷ We know from Table 1 that employed parents spend considerably more time in enriching activities on nonwork days than on workdays. So to correctly estimate the effect of working on the timing of enriching childcare, it is necessary to control for the time spent in these activities on the diary day. We also controlled for demographic characteristics and household composition to account for any differences between the workday and nonwork day samples, but, as expected, these controls make very little difference.

The three graphs in Figure 5 show the coefficient on the “workday” dummy along with upper and lower bounds of the 95% confidence interval. To account for the ATUS’s complex sample design, we used replicate weights to compute standard errors.¹⁸

A smaller fraction of full-time employed parents (panels a and c) are engaged in enriching childcare activities during normal working hours on workdays compared to nonwork days, and a larger fraction is engaged during the after-work evening hours. Keeping in mind the small fraction of parents that are engaged in enriching care at any given time, these effects (about -0.05 for mothers and -0.10 for fathers) are large and statistically significant at about the 95 percent level. Thus it appears that these parents shift the time they spent in enriching childcare

the probability on nonwork days as well as the difference between work and nonwork days. The probabilities on nonwork days are low enough at some times of day that even the small variation that we observe in our data causes the odds ratios to vary widely. These results are available from the authors on request.

¹⁷ Our qualitative results are not sensitive to this sample restriction.

¹⁸ As a check, we computed using two alternative procedures: (1) we computed Huber-White standard errors clustering on a pseudo-PSU variable that was created by combining ATUS’s pseudo-cluster variable (GEPSEUCL) and state, and (2) we computed standard errors using the survey methods commands in STATA with the same pseudo-PSU variable. Both of these procedures produced standard errors that were nearly identical to those from the replicate-weight procedure.

activities to less-productive times of day in order to accommodate full-time employment. The smaller effects for full-time employed mothers, compared to fathers, could be due to the fact that they work fewer hours (34 hours per week vs. 41.5 hours for full-time men). It could also be the case that mothers make greater efforts to spend time with their children during higher-productivity times of day.¹⁹ Finally, a larger fraction of full-time employed fathers have nonworking spouses who can spend time with the children during the day. Thus full-time employed fathers are more likely to have a substitute (from the children's perspective) for their time with children during the day. It is worth noting that all of the shifted enriching care is playing with children. Reading to children is done almost exclusively in the evening, presumably as part of the bedtime routine.

The coefficients for part-time employed mothers do not show the clear pattern of shifting that is present among full-time employed mothers. The coefficients on the worked variable fluctuate considerably by time of day, and the coefficients are generally not statistically significant at the 95 percent level. The evening peak is lower and of shorter duration, and between about 10:00am and 1:00pm the effect of working on the diary day is mostly positive (though not statistically significant). To be sure, there are times when the effect is negative, large, and statistically significant, but these times are of relatively short duration. Thus, it appears that part-time employed mothers spend relatively more time in enriching care activities at high-productivity times on workdays.

Although our results say nothing about causality, it seems likely that one of the reasons that mothers work part-time is so that they have the flexibility to schedule work in order to spend more time with their children during higher-productivity times of day. This explanation is

¹⁹ In results not presented here, we found that when parents worked less than 7 hours on the diary day they tended to leave work early rather than going to work later. This effect is moderate, though not statistically significant.

consistent with the results of Ichino and Sanz de Galdeano (2005), who find that the availability of part-time jobs and flexible employment arrangements is a more important determinant of maternal employment rates than the availability of formal childcare facilities. Their research suggests that many of these part-time employed mothers would choose not to work, rather than work full time, if part-time jobs were not available.

Figure 6 shows how enriching childcare is distributed throughout the day. Among mothers and fathers who were employed full time, over 60 percent of the time spent in enriching activities on workdays is spent between 5pm and 9pm compared to less than 35 percent on nonwork days (panels b, e, and f). On nonwork days about half of the time in enriching activities is spent between 8am and 5pm versus 15 to 20 percent on workdays. In contrast, the distributions of time spent in enriching activities on workdays and nonwork days are more similar to each other for mothers who work part time. On workdays nearly 40 percent of enriching childcare activities are done between 8am and 5pm, compared with a little over half on nonwork days. A little under 40 percent of enriching childcare is done between 5pm and 9pm on workdays, compared to about 25 percent on nonwork days. As a point of comparison, nonemployed mothers and fathers spend about half of their time in enriching activities between 8am and 5pm and only one-quarter between 5pm and 9pm. Thus, the distribution of part-time employed mothers' time in enriching childcare on workdays looks much like that of nonemployed mothers.

Summary and Conclusions

The time that parents spend in enriching childcare activities is an important parental input to child development. The extensive literature on this subject has focused on the amount of time spent in these types of activities, but has largely ignored when these activities take place. The

psychological literature on circadian rhythms suggests that timing matters because people have preferences over the time of day that vary systematically with age, with young children tending to prefer the morning and adults tending to prefer the afternoon and evening. Other research shows that people perform better on complex tasks at their preferred times. This suggests that, because enriching care activities are likely to be more complex for young children than for their parents, the value of enriching care to the children is greater in the morning than in the afternoon or evening, although productivity depends on the parent's time-of-day preference as well as the children's.

Our theoretical model predicts that, all else equal, parents will want to spend more time in enriching care when that time is most productive. But if these more-productive times of day coincide with times when the productivity of market work is high, the model predicts that parents will shift enriching care activities to times of day when those activities are less productive.

Our empirical analysis compares the timing of enriching childcare done by employed parents on workdays and nonwork days. The relatively large amount of time parents spend in enriching care in the morning and early afternoon on nonwork days is consistent our theoretical model and with findings in the psychological literature that children prefer mornings to evenings. After controlling for the amount of time spent in enriching activities, we found that full-time employed parents shifted time spent in enriching activities to later in the day on workdays. This may not seem too surprising because most people work during normal working hours. The effect is larger for full-time employed fathers than for full-time employed mothers, which suggests that mothers are more willing or better able to adjust their schedules to spend time with their children earlier in the day. Although we controlled for the presence of older children in the household, it is still possible that they play an additional role in the timing of enriching care.

The results for part-time employed mothers are intriguing. It appears that part-time employed mothers shift enriching childcare activities to a much lesser extent. Thus, our results suggest that mothers who work part time do so not only to spend more time with their children, but also to spend better time. This result is important because it implies that the greater ability to choose when they work is one of the attributes that makes part-time work desirable to working mothers.

Our results also imply that looking only at the amount of time spent in enriching childcare activities understates the full impact of parental employment. Combined with the results from research on circadian rhythms, they imply that parental time in enriching childcare activities on workdays is less valuable for young children because these activities occur at less-preferred times of day, when these children are less receptive to learning. The time may also be less enjoyable for parents because young children tend to be cranky and less cooperative later in the day, when they are tired. Parents' shifting of enriching childcare time from workdays to nonwork days mitigates this negative effect somewhat, because it allows parents to spend relatively more time with their children at high-productivity times of day. But this between-day shifting can only go so far, because young children require daily interaction.

It is worth noting that these results do not necessarily imply that the children of employed parents are worse off. Presumably, these children are in some sort of daycare or preschool, where they can participate in enriching activities with their preschool teachers and with other children. Whether children are worse off depends on how substitutable this time is for parental time.

The results do suggest one way that parents of young children benefit from flexible work schedules and why part-time employed mothers might be willing to accept lower wages. Our

results also imply that parents would value having childcare facilities at or near their workplace so that they could interact with their children during the day on workdays.

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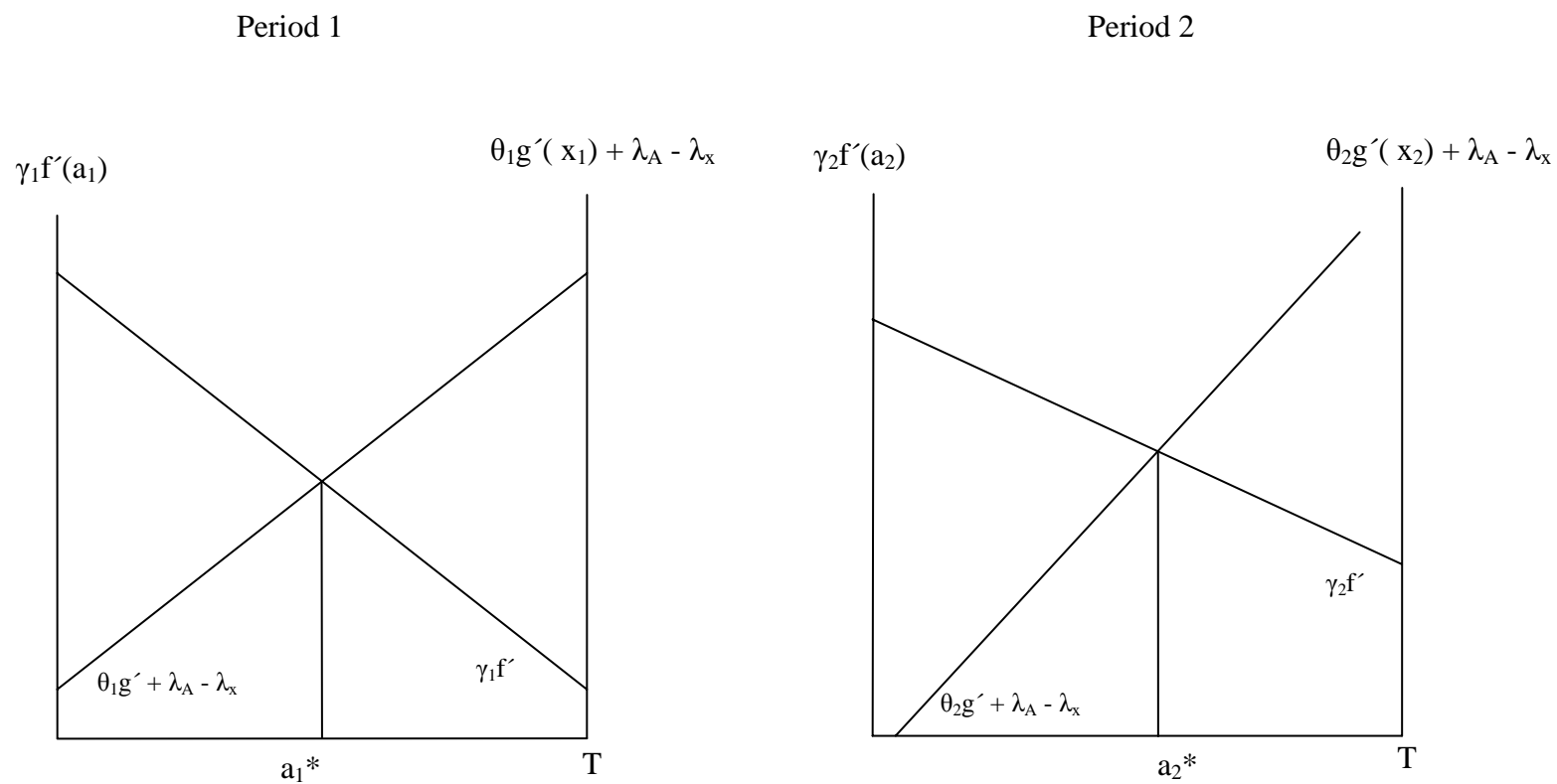
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Figure 1(a)



Note: Time spent in activity A is measured from the left axis, while time spent in activity X is measured from the right axis.

Figure 1(b)

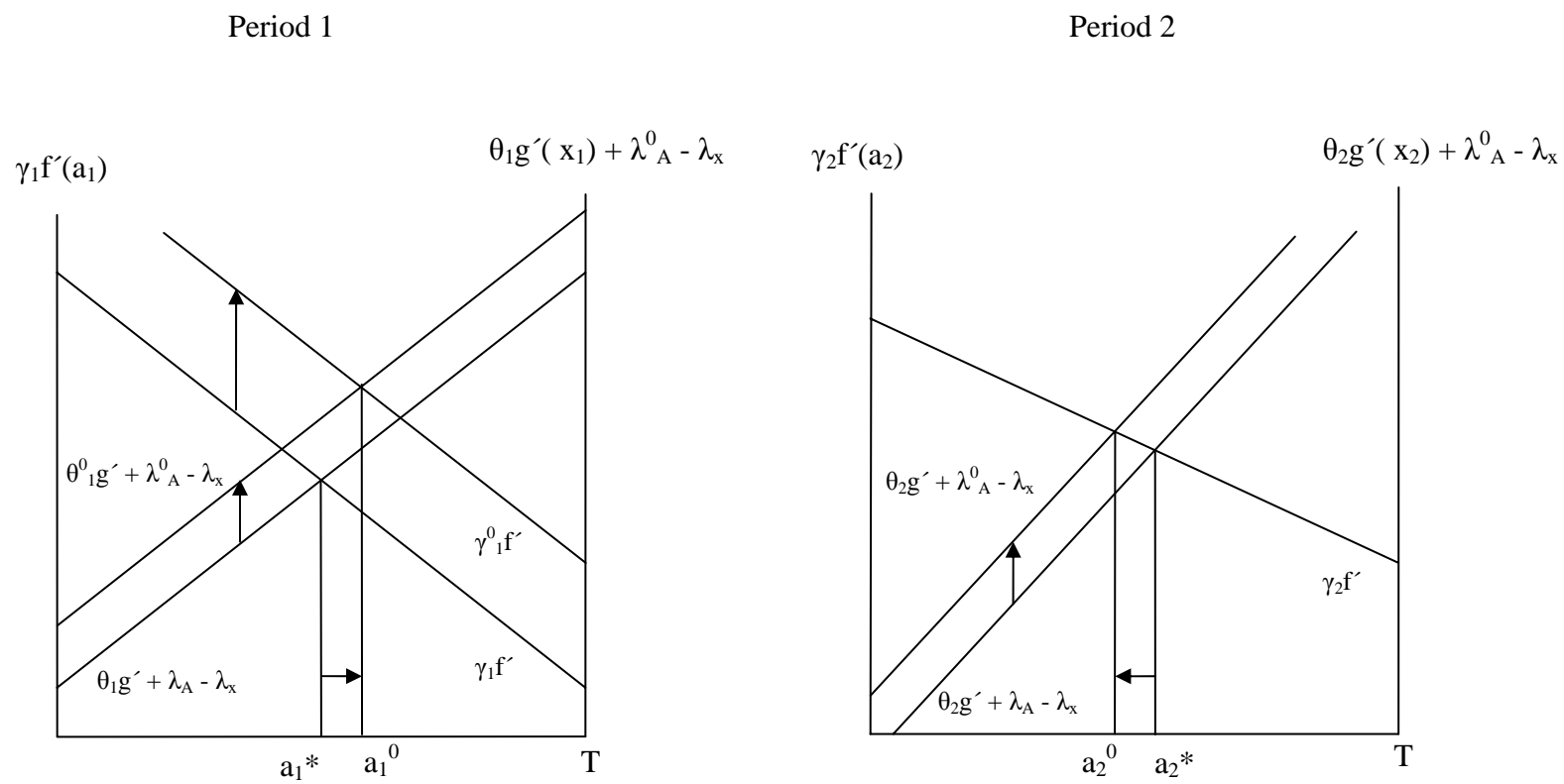


Table 1. Hours spent in childcare by mothers and fathers on an given day, 2003-2006 ATUS annual averages

	Mothers							Fathers			
	Employed full time			Employed part time			Not employed	Employed full time			Not employed
	Total	Workdays (away from home)	Nonwork Days*	Total	Workdays (away from home)	Nonwork Days*		Total	Workdays (away from home)	Nonwork Days*	
Childcare (with child < 5)	2.0	1.7	2.5	2.7	2.0	3.2	3.1	1.2	0.9	1.7	1.6
Routine childcare	1.1	0.9	1.5	1.4	1.0	1.7	1.7	0.5	0.4	0.8	0.7
Enriching childcare	0.6	0.4	0.8	0.9	0.6	1.1	1.0	0.5	0.4	0.8	0.7
Playing with children	0.4	0.3	0.6	0.7	0.4	0.9	0.8	0.4	0.3	0.7	0.5
Reading to children	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.1	0.0
Other childcare	0.3	0.4	0.3	0.4	0.4	0.4	0.4	0.1	0.1	0.1	0.2
Observations	2,043	937	1,106	1,172	421	751	2,163	3,451	1,850	1,601	274

* Includes days on which the respondent worked at home and did not work away from home.

Note: sample restricted to parents age 18 and over with at least one child under age 5 living in the household. All childcare estimates include only times when parents were with at least one of their children under age 5.

Figure 2. Childcare (with child less than 5)
Percent providing childcare by time of day, 2003-2006 annual averages

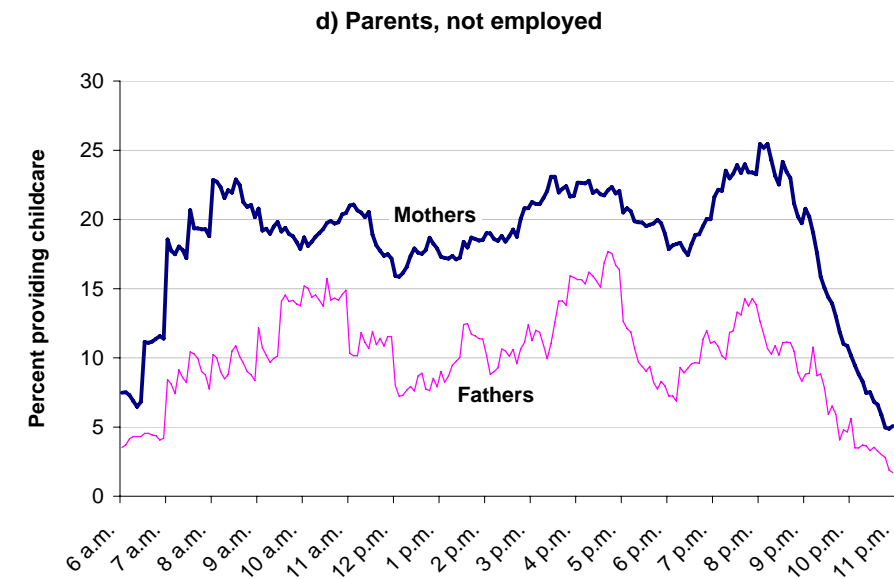
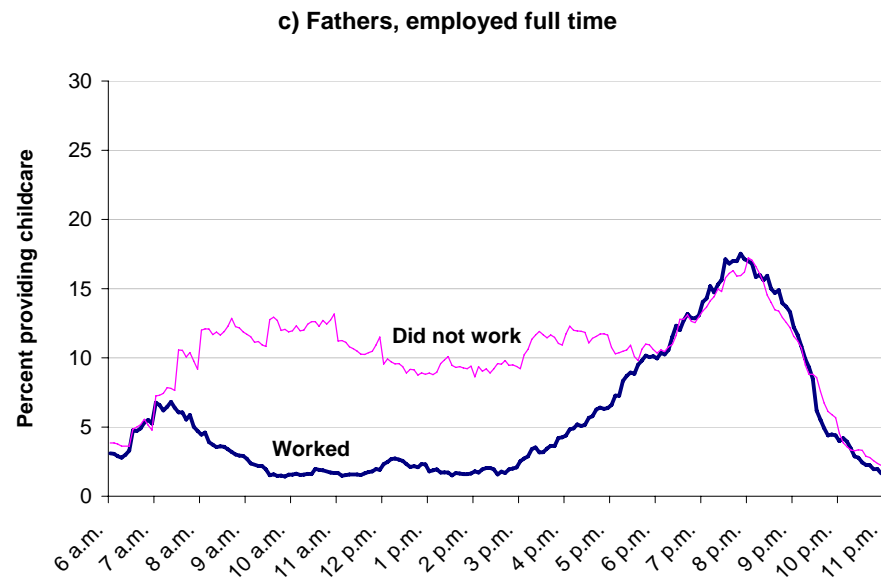
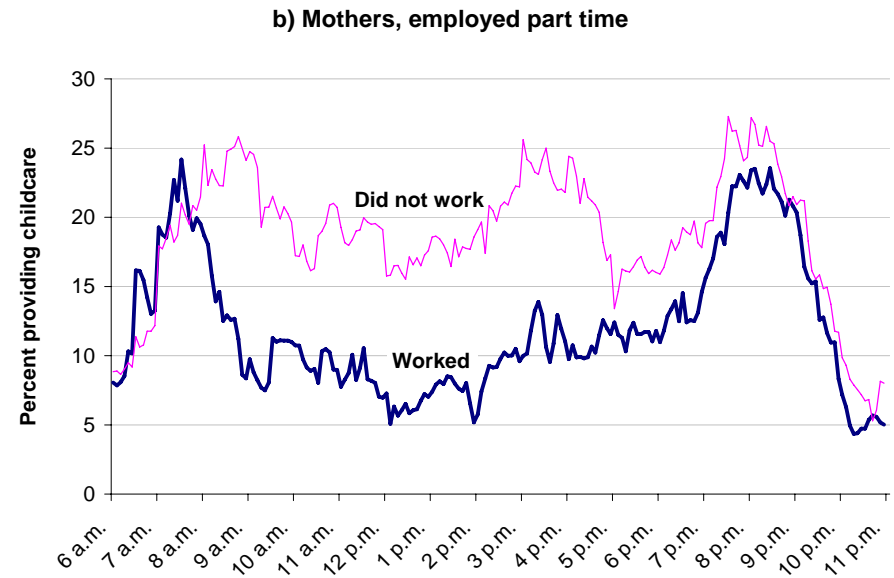
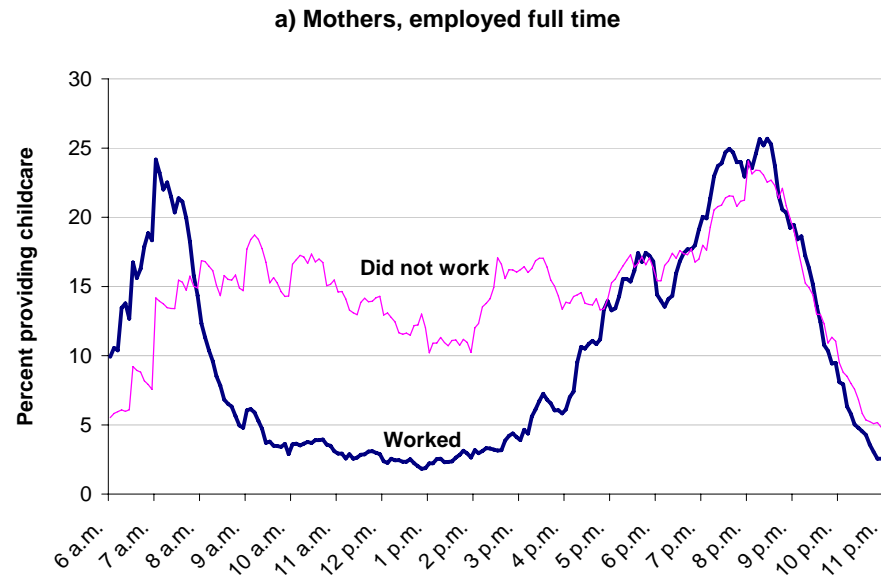
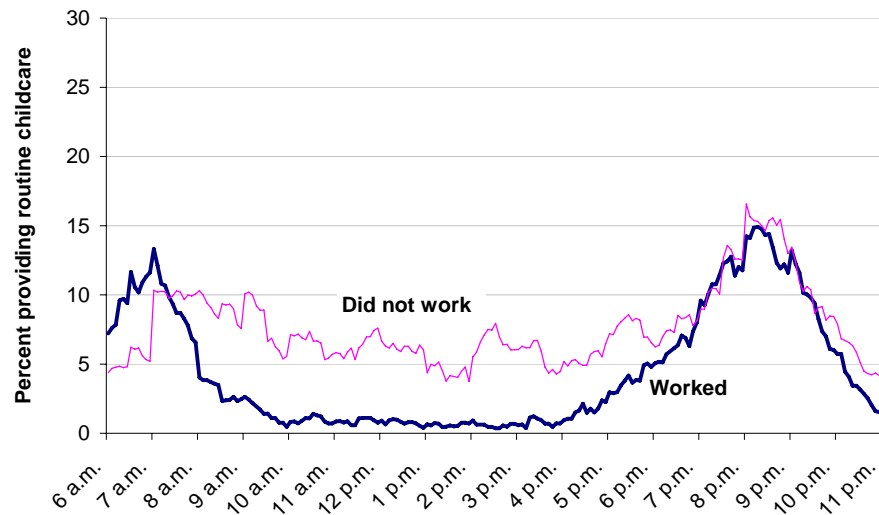
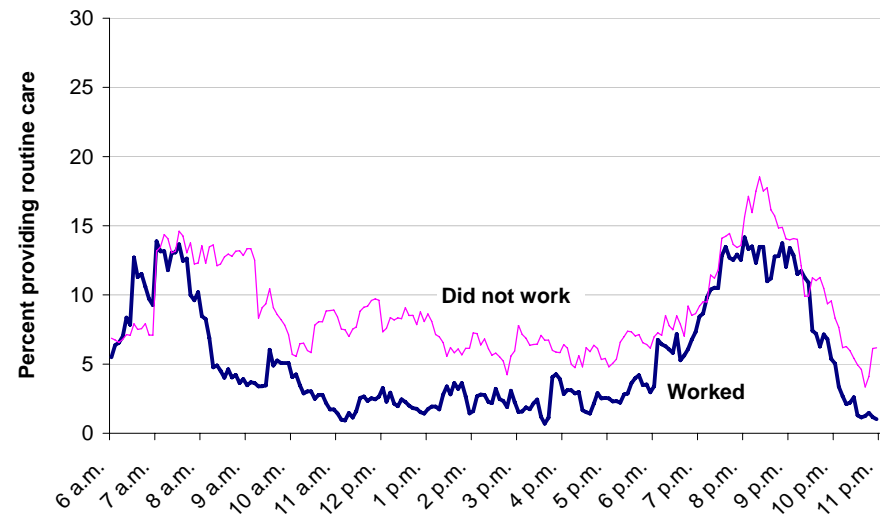


Figure 3. Routine childcare (with child less than 5)
Percent providing routine childcare by time of day, 2003-2006 annual averages

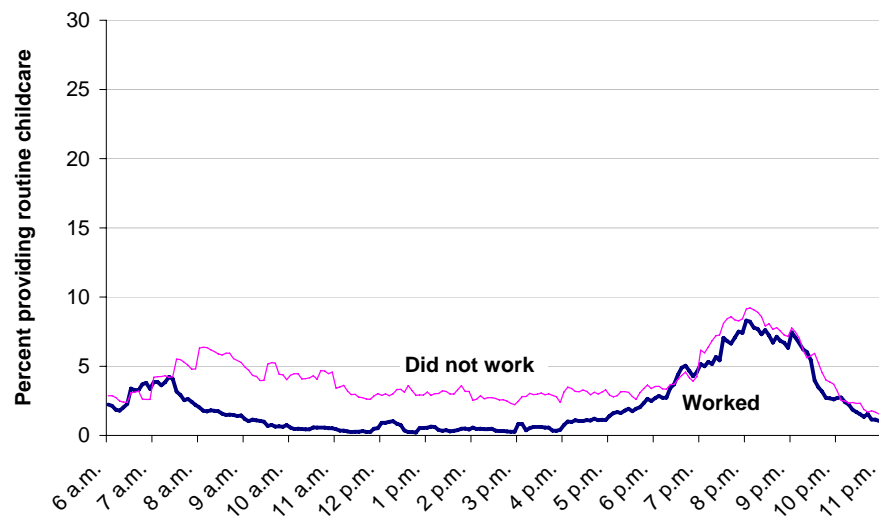
a) Mothers, employed full time



b) Mothers, employed part time



c) Fathers, employed full time



d) Parents, not employed

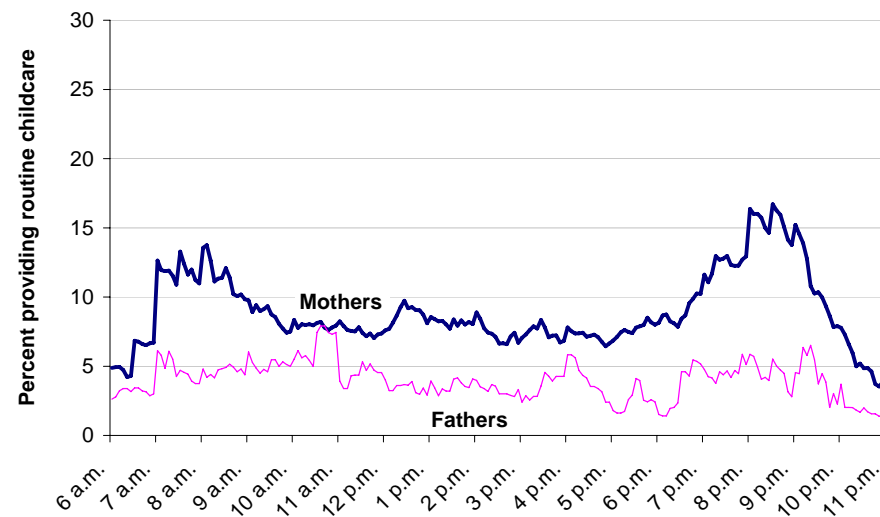
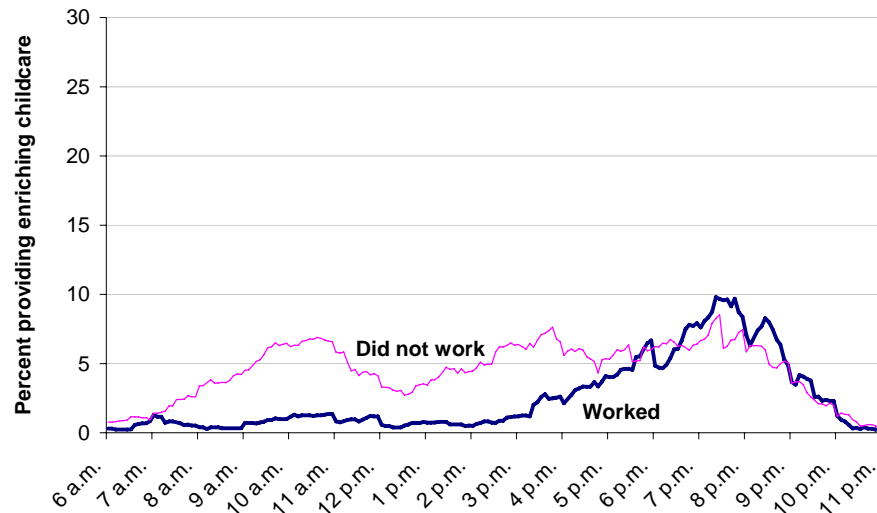
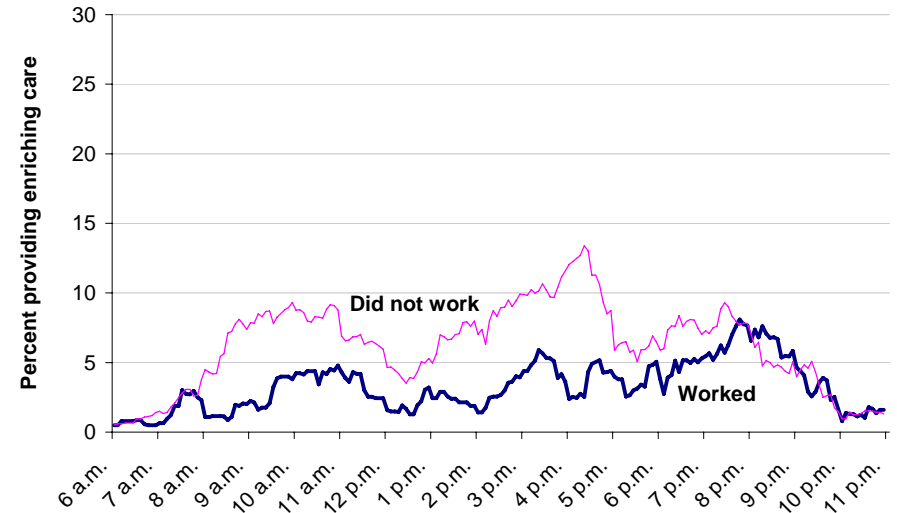


Figure 4. Enriching childcare (with child less than 5)
Percent providing enriching childcare by time of day, 2003-2006 annual averages

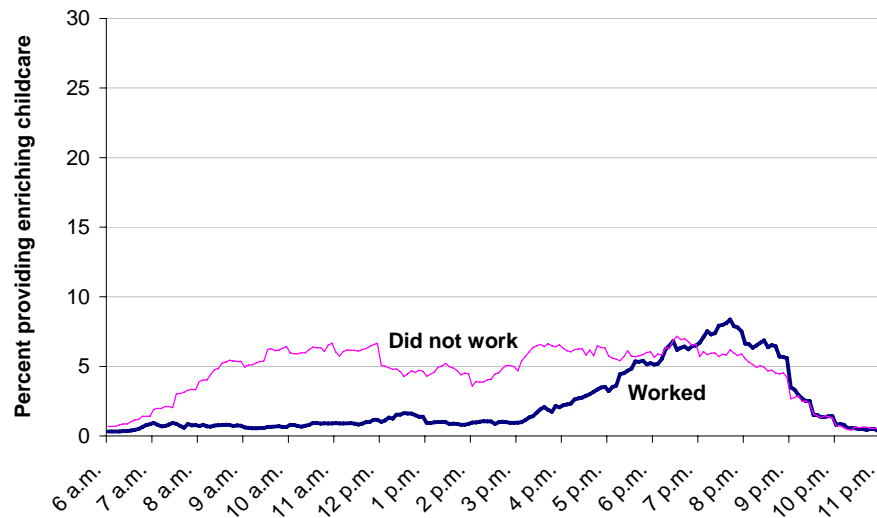
a) Mothers, employed full time



b) Mothers, employed part time



c) Fathers, employed full time



d) Parents, not employed

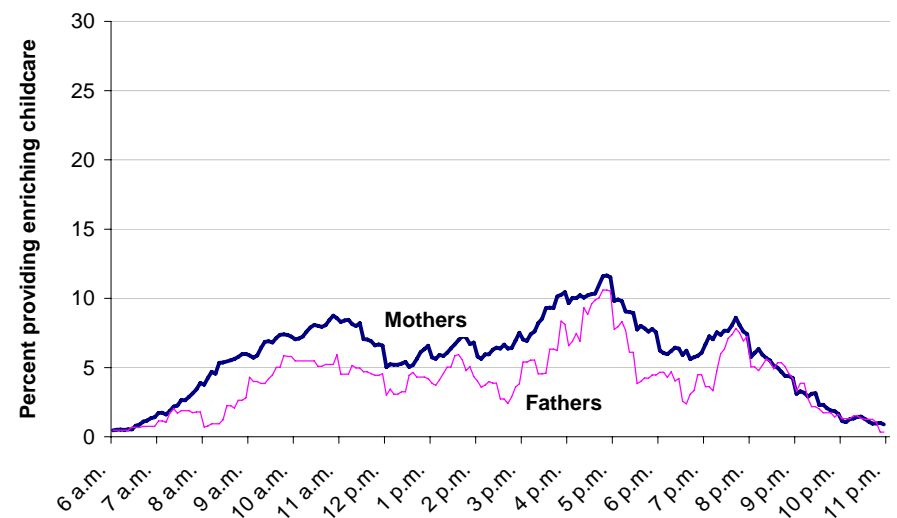
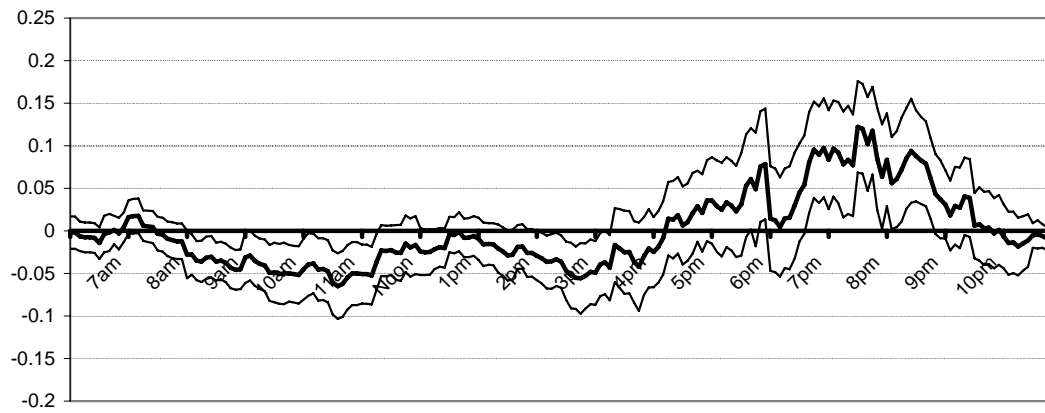
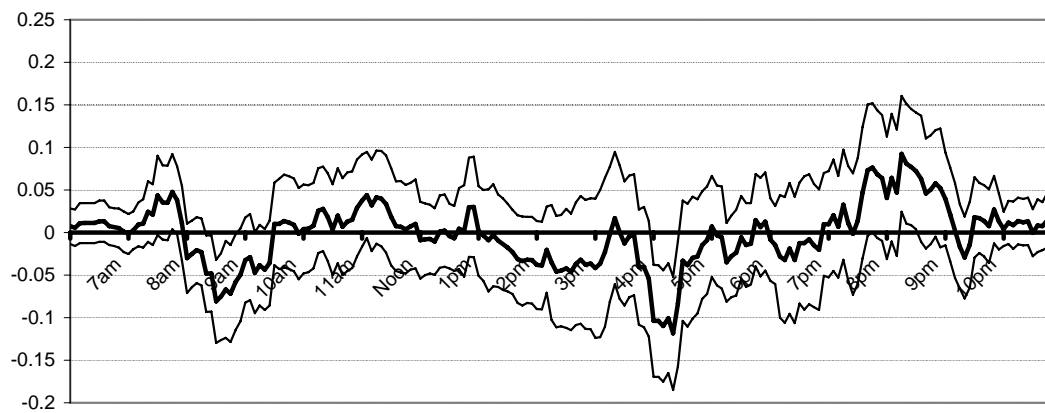


Figure 5: The Effect of Working on the Fraction of Parents Engaged in Enriching Childcare Activities at Different Times of Day

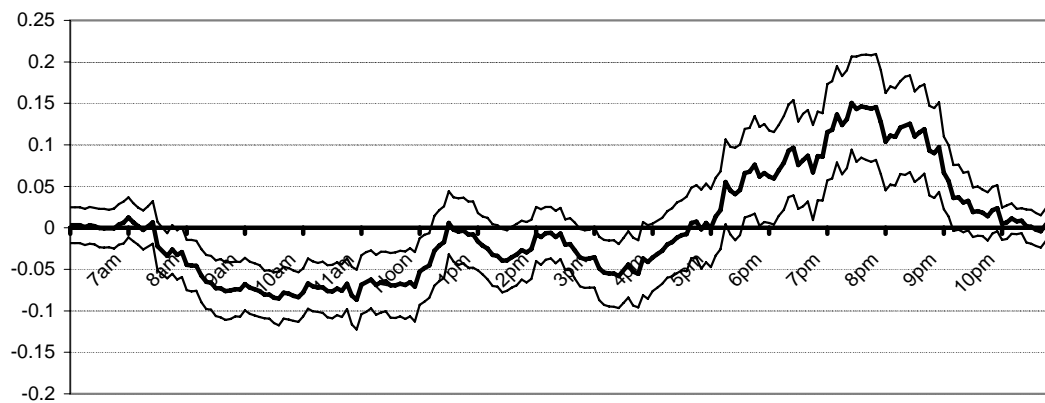
(a) Full-Time Employed Mothers



(b) Part-Time Employed Mothers



(c) Full-Time Employed Fathers



— Coefficient on Workday Indicator — 95% CI — 95% CI

Figure 6: Distribution of Time Spent in Enriching by Time of Day

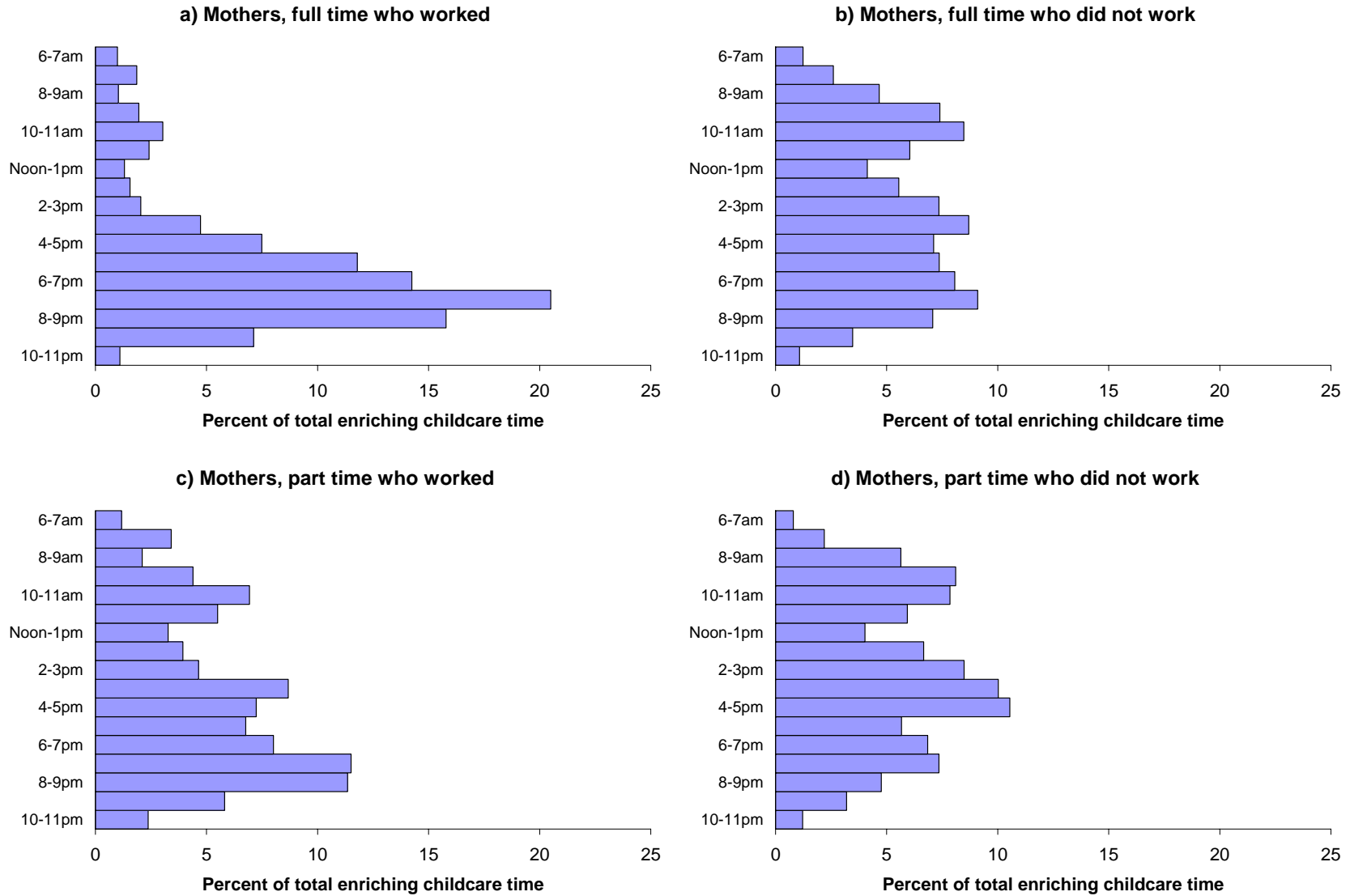
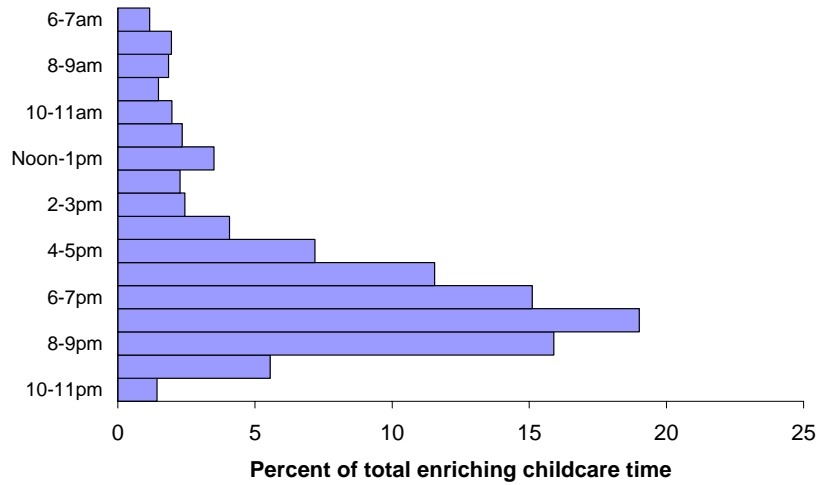
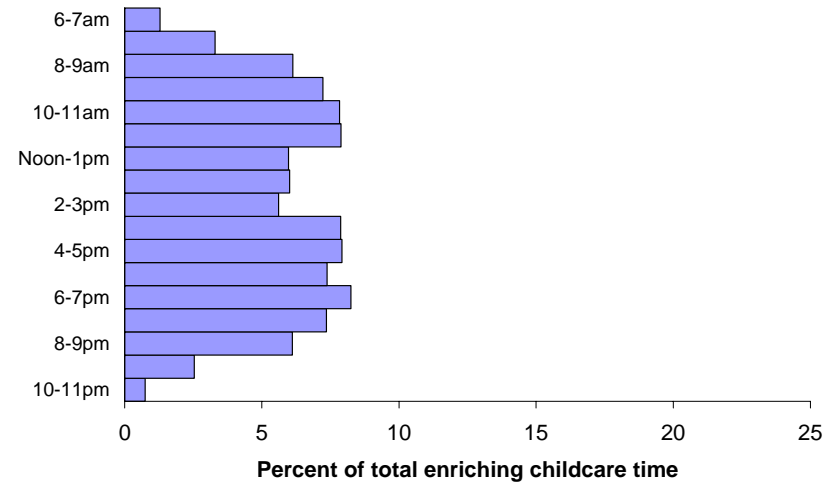


Figure 6: Distribution of Time Spent in Enriching by Time of Day (continued)

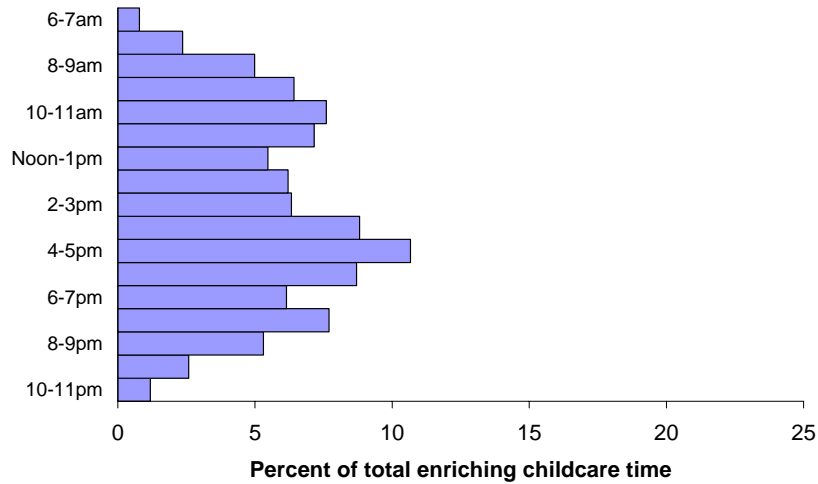
e) Fathers, full time who worked



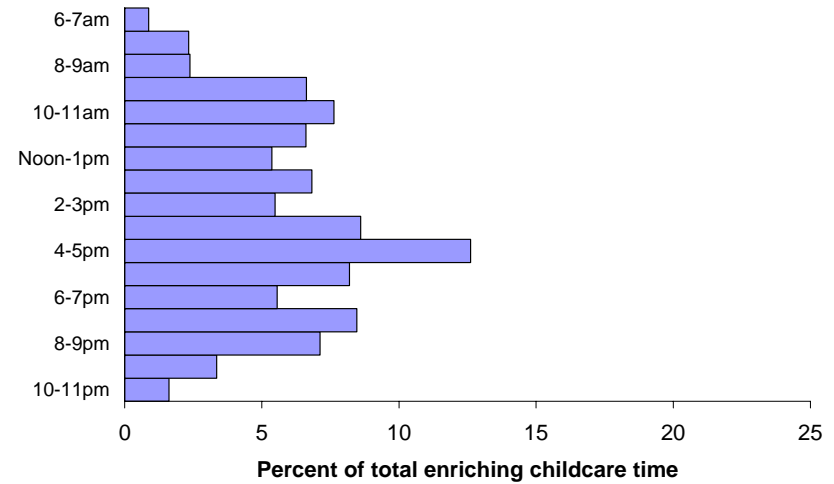
f) Fathers, full time who did not work



g) Mothers, not employed



h) Fathers, not employed



Appendix A. Classification of activities among routine care, quality care, and unclassified care

Routine childcare

030101	Physical care of household children
030109	Looking after children as a primary activity
030301	Providing medical care to household children

Enriching childcare

030102	Reading to/with household children
030103	Playing with household children, not sports
030104	Arts and crafts with household children
030105	Playing sports with household children
030106	Talking with/listening to household children
030107	Helping/teaching household children (not related to education)
030201	Homework (household children)
030203	Homeschooling of household children

Other childcare

030108	Organization and planning for household children
030110	Attending household children's events
030111	Waiting for/with household children
030112	Picking up/dropping off household children
030199	Caring for and helping household children, not elsewhere classified
030202	Meetings and school conferences (household children)
030204	Waiting associated with household children's education
030299	Activities related to household children's education, not elsewhere classified
030302	Obtaining medical care for household children
030303	Waiting associated with household children's health
030399	Activities related to household children's health, not elsewhere classified
170301	Travel related to caring for and helping household children
180301	Travel related to caring for and helping household children
180302	Travel related to household children's education
180303	Travel related to household children's health